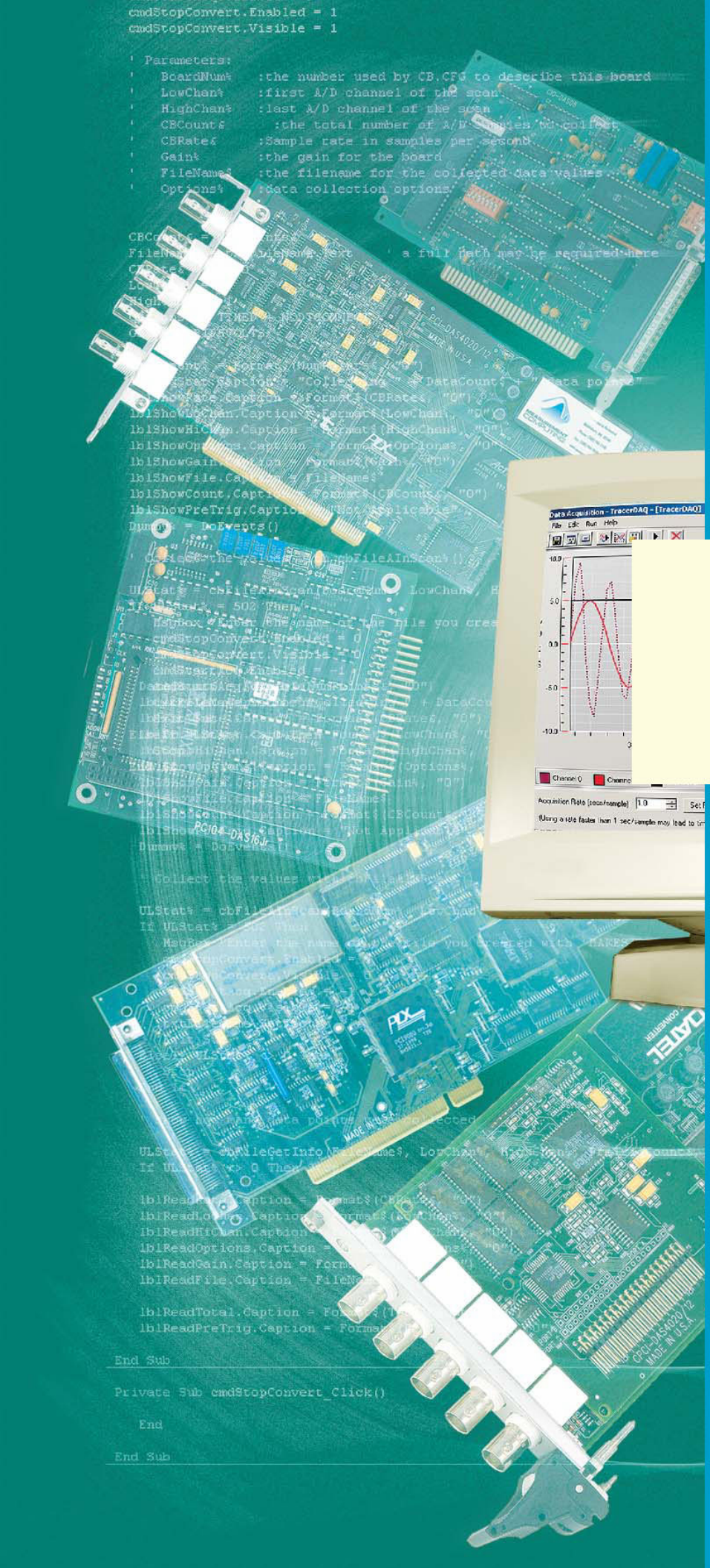

User's Guide

PCI-DAS08

Analog Input and Digital I/O

MEASUREMENT COMPUTING™

PCI-DAS08

Analog input and Digital I/O

User's Guide

MEASUREMENT COMPUTING™

Document Revision 4, May, 2005
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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the PCI-DAS08 so that you get the most out of the analog input and digital I/O features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:

1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:

- The *Insta*Cal installation procedure is explained in the *DAQ Software Quick Start*.
- Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide information that is relevant to the operation of the PCI-DAS08.

- The *Specifications: PCI-DAS08* (the PDF version of Chapter 4 in this guide) is available on our web site at www.mccdaq.com/pdfs/PCI-DAS08.pdf.
- The *Register Map for the PCI-DAS08* is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-DAS08.pdf.
- MCC's *DAQ Software Quick Start* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- The *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- The *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

This user's manual is also available on our web site at www.mccdaq.com/PDFmanuals/PCI-DAS08.pdf.

Introducing the PCI-DAS08

Overview: PCI-DAS08 features

This manual explains how to configure, install, and use your PCI-DAS08 board. The PCI-DAS08 is a multifunction measurement and control board designed to operate in computers with PCI bus accessory slots.

The PCI-DAS08 board provides the following features:

- Eight single-ended 12-bit analog inputs
- 12-bit A/D resolution
- Sample rates of up to 40 kHz
- ±5V input range
- Three 16-bit counters
- Seven digital I/O bits (three input, four output)
- Connector compatible with Measurement Computing's ISA-based CIO-DAS08 board

The PCI-DAS08 board is completely plug-and-play compliant, with no switches or jumpers to set. Configuration is controlled by your system's plug-and-play software. A functional block diagram of the PCI-DAS08 is shown here.

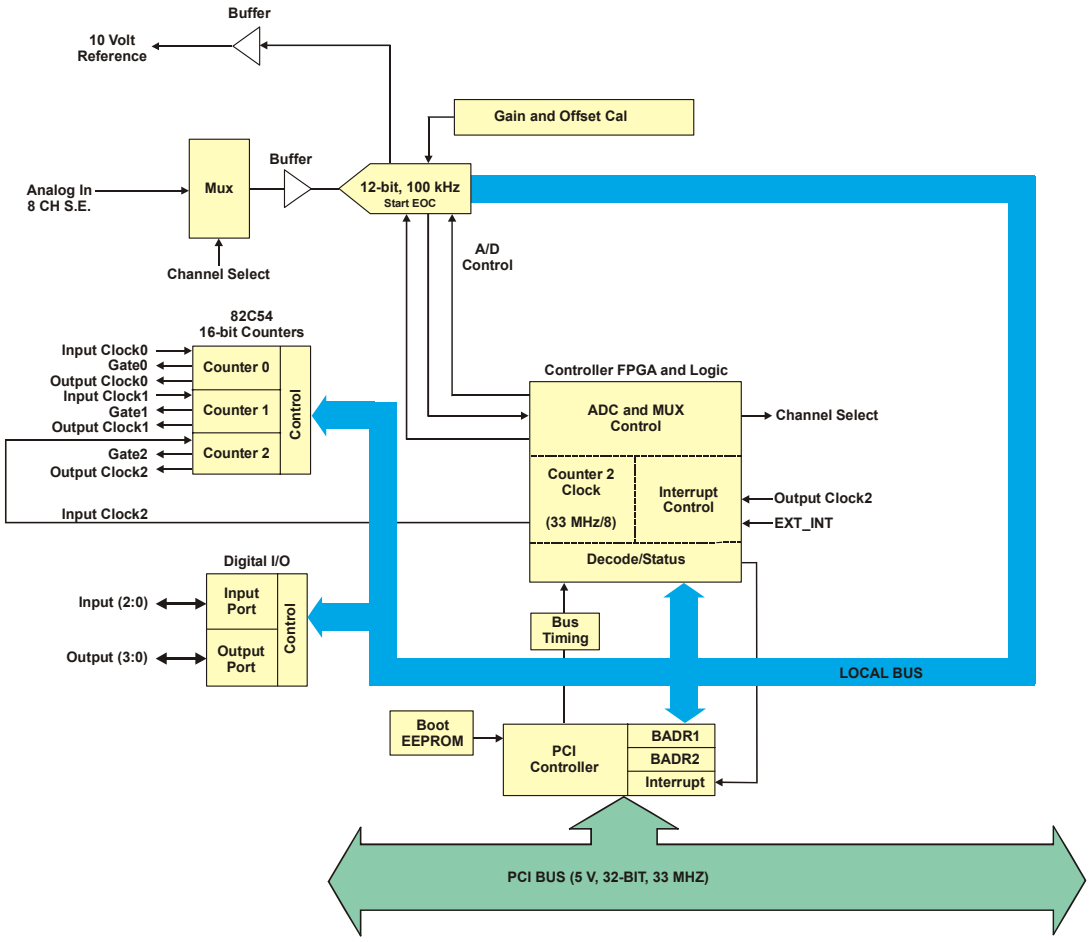


Figure 1-1. PCI-DAS08 block diagram

Software features

The following software ships with the PCI-DAS08 free of charge.

- *Insta*Cal installation, calibration, and test utility
- TracerDAQ™ suite of virtual instruments
- SoftWIRE® for Visual Studio® .NET graphical programming
- MCC DAQ Components for VS .NET (installed with SoftWIRE® for VS .NET)

For information on the features of *InstaCal*, TracerDAQ, and SoftWIRE, refer to the *DAQ Software Quick Start* booklet that ships with the PCI-DAS08.

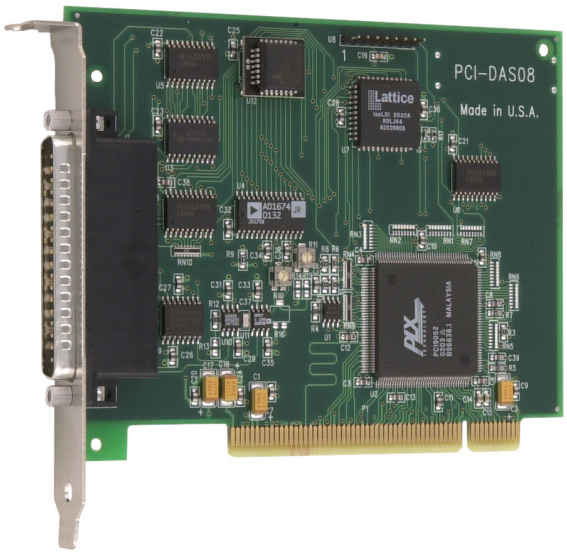
Installing the PCI-DAS08

What comes with your shipment?

As you unpack your board, make sure each of the items shown below is included:

Hardware

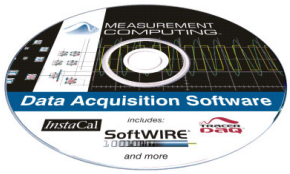
- PCI-DAS08



Software

The *Measurement Computing Data Acquisition Software* CD contains the following software:

- *Insta*Cal installation, calibration, and test utility
- TracerDAQ™ suite of virtual instruments
- SoftWIRE® for VS .NET
- SoftWIRE MCC DAQ Components for .NET



Documentation

In addition to this hardware user's guide, you should also receive the *DAQ Software Quick Start* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). Please read this booklet completely before installing any software and hardware.

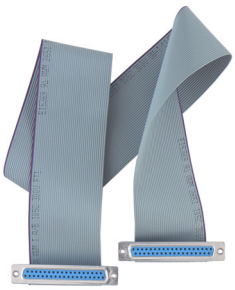
Optional components

If you ordered any of the following products with your board, they should be included with your shipment.

Universal Library

- Universal Library™ Data Acquisition and Control Programming Tools (also includes the *Insta*Cal utility, the *Universal Library User's Guide*, and the *Universal Library Function Reference*)

Cables



C37FF-x

C37FFS-x

Signal termination and conditioning accessories

MCC provides signal termination products for use with the PCI-DAS08. Refer to the "Field wiring, signal termination and signal conditioning" section for a complete list of compatible accessory products.

Unpacking the board

The PCI-DAS08 boards are shipped in an antistatic container to prevent damage by an electrostatic discharge. To avoid such damage, perform the following procedure when unpacking and handling your board.

1. Before opening the antistatic container, ground yourself with a wrist-grounding strap or by holding onto a grounded object.
2. Touch the antistatic container to the computer chassis before removing the board from the container.
3. Remove the board from the container. *Never* touch the exposed pins or circuit connections on the board.

If your board is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail. For international customers, contact your local distributor where you purchased the board.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support

- Email: techsupport@measurementcomputing.com

Installing the software

Install the software included with your board *before* you install the hardware. Installing the software first ensures that the information required for proper board detection is installed and available at boot up.

Refer to the *DAQ Software Quick Start* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is shipped with the hardware, and is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the hardware

The PCI-DAS08 board is completely plug-and-play, with no switches or jumpers to set. Configuration is controlled by your system's BIOS. To install your board, follow the steps below.

Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *DAQ Software Quick Start* for instructions on installing the software.

1. Turn your computer off, remove the cover, and insert your board into an available PCI slot.
2. Close your computer and turn it on.

   If you are using an operating system with support for plug-and-play (such as Windows 2000 or Windows XP), a dialog box displays as the system loads, indicating that new hardware has been detected. If the information file for this board is not already loaded onto your PC, you are prompted for the disk containing this file. The *Measurement Computing Data Acquisition Software* CD supplied with your board contains this file. If required, insert the disk or CD and click **OK**.
3. To test your installation and configure your board, run the *Insta*Cal utility you installed in the previous section. Refer to the *DAQ Software Quick Start* that came with your board (www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf) for information on how to initially set up and load *Insta*Cal.
4. If your board has been powered-off for more than 10 minutes, allow your computer to warm up for at least 15 minutes before acquiring data. This warm-up period is required for the board to achieve its rated accuracy. The high speed components used on the board generate heat, and it takes this amount of time for a board to reach steady state if it has been powered off for a significant amount of time.

Configuring the hardware

All of the hardware configuration options on the PCI-DAS08 are software controlled. You can select some of the configuration options using InstaCal, such as the counter source and interrupt source. Once selected, any program that uses the Universal Library will initialize the hardware according to these selections.

Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections*. This document is available at http://www.measurementcomputing.com/signals/signals.pdf.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

Table 2-1 lists the board connectors, applicable cables and compatible accessory boards.

Table 2-1. Board Connectors, cables, accessory equipment

Connector type	37-pin male "D" connector
Compatible cables	C37FF-x 37-pin cable. x = length in feet (Figure 2-2).
	C37FFS-x 37-pin shielded cable. x = length in feet (Figure 2-3).
Compatible accessory products (with the C37FF-x cable)	CIO-MINI37 SCB-37 ISO-RACK08
Compatible accessory products (with the C37FFS-x cable)	CIO-MINI37 SCB-37 ISO-RACK08 CIO-EXP16 CIO-EXP32 CIO-EXP-GP CIO-EXP-BRIDGE16 CIO-EXP-RTD16

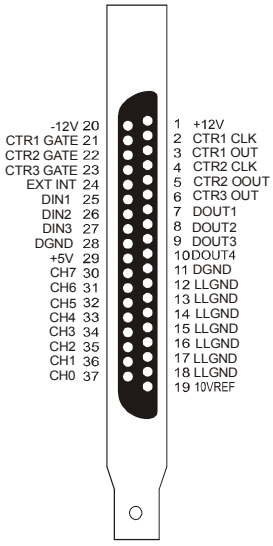


Figure 2-1. 37-pin connector pinout

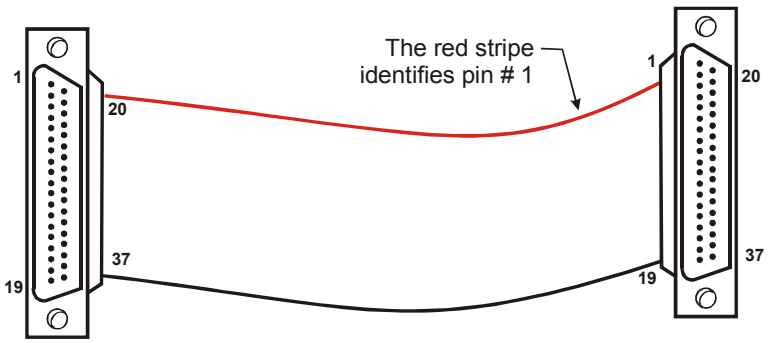


Figure 2-2. C37FF-x cable

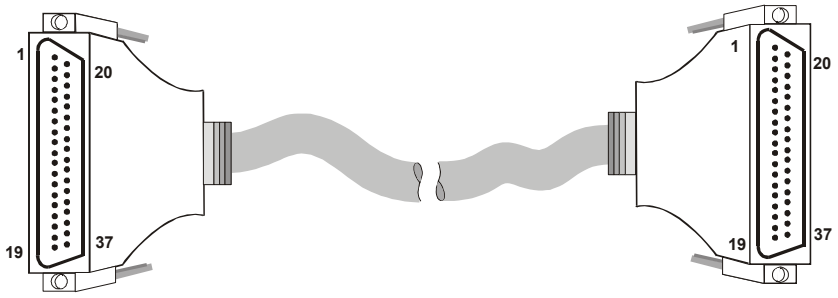


Figure 2-3. C37FFS-x cable

Caution! If either the AC or DC voltage is greater than 5 volts, do not connect the PCI-DAS08 to this signal source. You are beyond the board's usable input range and will need to either adjust your grounding system or add special isolation signal conditioning to take useful measurements. A ground offset voltage of more than 7 volts may damage the PCI-DAS08 board and possibly your computer. An offset voltage much greater than 7 volts will damage your electronics, and may be hazardous to your health.

Field wiring, signal termination and signal conditioning

You can use the following MCC screw terminal boards to terminate field signals and route them into the PCI-DAS08 board using the C37FF-x or C37FFS-x cable:

- CIO-MINI37 – 37-pin screw terminal board. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- SCB-37 – 37 conductor, shielded signal connection/screw terminal box that provides two independent 50-pin connections. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.

MCC provides the following analog signal conditioning products for use with your PCI-DAS08 board:

- ISO-RACK08 – Isolated 8-channel, 5B module rack for analog signal conditioning and expansion. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=127&pf_id=449.
- CIO-EXP16 – 16-channel analog multiplexer board with on-board CJC sensor. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=249.
- CIO-EXP32 – 32-channel analog multiplexer board with on-board CJC sensor and 2 Gain amps. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=250.
- CIO-EXP-GP – 8-channel expansion multiplexer board with resistance signal conditioning. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=244.
- CIO-EXP-BRIDGE16 – 16-channel expansion multiplexer board with Wheatstone bridge signal conditioning. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=243.
- CIO-EXP-RTD16 – 16-channel expansion multiplexer board with RTD signal conditioning. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=248.

Programming and Developing Applications

After following the installation instructions in Chapter 2, your board should now be installed and ready for use. Although the board is part of the larger DAS family, there is no correspondence among registers for different boards. Software written at the register level for other DAS models will not function correctly with the PCI-DAS08 board.

Programming languages

Measurement Computing's Universal Library™ provides access to board functions from a variety of Windows programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, refer to the *Universal Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged application programs

Many packaged application programs, such as SoftWIRE®, Labtech Notebook™, and HP-VEE™, now have drivers for your board. If the package you own does not have drivers for the board, please fax or e-mail the package name and the revision number from the install disks. We will research the package for you and advise how to obtain drivers.

Some application drivers are included with the Universal Library package, but not with the application package. If you have purchased an application package directly from the software vendor, you may need to purchase our Universal Library and drivers. Please contact us by phone, fax or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@measurementcomputing.com

Register-level programming

You should use the Universal Library or one of the packaged application programs mentioned above to control your board. Only experienced programmers should try register-level programming.

If you need to program at the register level in your application, you can find more information in the *Register Map for the PCI-DAS08 Series* (available at www.mccdaq.com/registermaps/RegMapPCI-DAS08.pdf).

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

Analog input

Table 4-1. Analog input specifications

Parameter	Specification
A/D converter type	*AD1674J*
Resolution	12 bits
Ranges	±5 V
A/D pacing	Software polled
A/D triggering modes	*Digital: Software polling of digital input (DIN1) followed by pacer loading and configuration.*
Data transfer	Software polled
Polarity	Bipolar
Number of channels	8 single-ended
A/D conversion time	*10 µs*
Throughput	40 kHz typical, PC dependent
Relative accuracy	±1 LSB
Differential linearity error	No missing codes guaranteed
Integral linearity error	±1 LSB
Gain drift (A/D specs)	*±180 ppm/°C*
Zero drift (A/D specs)	*±60 ppm/°C*
Input leakage current	*±60 nA max over temperature*
Input impedance	*10 MegOhm min*
Absolute maximum input voltage	*±35 V*
Noise distribution	(Rate = 1-50 kHz, Average % ± 2 bins, Average % ± 1 bin, Average # bins) Bipolar (5 V): 100% / 100% / 3 bins

Digital input / output

Table 4-2. Digital I/O specifications

Parameter	Specification
Digital type (main connector):	
Output	*74ACT273*
Input	*74LS244*
Configuration	*3 fixed input, 4 fixed output*
Number of channels	*7*
Output high	*3.94 volts min @ -24 mA (Vcc = 4.5 V)*
Output low	*0.36 volts max @ 24 mA (Vcc = 4.5 V)*
Input high	*2.0 volts min, 7 volts absolute max*
Input low	*0.8 volts max, -0.5 volts absolute min*
Interrupts	INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enable	Programmable through PCI controller: 0 = disabled, 1 = enabled (default)
Interrupt sources	External source (EXT INT) Polarity programmable through PCI controller: 1 = active high, 0 = active low (default)

Counter section

Table 4-3. Counter specifications

Parameter	Specification	
Counter type	*82C54 device*	
Configuration	*3 down counters, 16-bits each*	
Counter 0 - User counter 1	Source:	Available at user connector (CTR1CLK)
	Gate:	Available at user connector (CTR1GATE)
	Output:	Available at user connector (CTR1OUT)
Counter 1 - User counter 2	Source:	Available at user connector (CTR2CLK)
	Gate:	Available at user connector (CTR2GATE)
	Output:	Available at user connector (CTR2OUT)
Counter 2 - User counter 3 or Interrupt Pacer	Source:	Buffered PCI clock (33 MHz) divided by 8.
	Gate:	Available at user connector (CTR3GATE)
	Output:	Available at user connector (CTR3OUT) and may be software configured as Interrupt Pacer.
Clock input frequency	*10 MHz max*	
High pulse width (clock input)	*30 ns min*	
Low pulse width (clock input)	*50 ns min*	
Gate width high	*50 ns min*	
Gate width low	*50 ns min*	
Input low voltage	*0.8 V max*	
Input high voltage	*2.0 V min*	
Output low voltage	*0.4 V max*	
Output high voltage	*3.0 V min*	

Power consumption

Table 4-4. Power consumption specifications

Parameter	Specification
+5 V operating (A/D converting to FIFO)	251 mA typical, 436 mA max
+12 V	13 mA typical, 19 mA max
-12 V	17 mA typical, 23 mA max

Environmental

Table 4-5. Environmental specifications

Parameter	Specification
Operating temperature range	0 to 50 °C
Storage temperature range	-20 to 70 °C
Humidity	0 to 90% non-condensing

Main connector and pin out

Table 4-6. Main connector specifications

Parameter	Specification
Connector type	37-pin male "D" connector
Compatible cables	C37FF-x cable
	C37FFS-x cable
Compatible accessory products (with C37FF-x cable)	CIO-MINI37 SCB-37 ISO-RACK08
Compatible accessory products (with C37FFS-x cable)	CIO-MINI37 SCB-37 ISO-RACK08 CIO-EXP16 CIO-EXP32 CIO-EXP-GP CIO-EXP-BRIDGE16 CIO-EXP-RTD16

Table 4-7. Main connector pin out

Pin	Signal Name	Pin	Signal Name
1	+12V	20	-12V
2	CTR1 CLK	21	CTR1 GATE
3	CTR1 OUT	22	CTR2 GATE
4	CTR2 CLK	23	CTR3 GATE
5	CTR2 OUT	24	EXT IN
6	CTR3 OUT	25	DIN1
7	DOUT1	26	DIN2
8	DOUT2	27	DIN3
9	DOUT3	28	DGND
10	DOUT4	29	+5V
11	DGND	30	CH7
12	LLGND	31	CH6
13	LLGND	32	CH5
14	LLGND	33	CH4
15	LLGND	34	CH3
16	LLGND	35	CH2
17	LLGND	36	CH1
18	LLGND	37	CH0
19	10V REF		

EC Declaration of Conformity

We, Measurement Computing Corporation, declare under sole responsibility that the product

PCI-DAS08	Low cost analog input and digital I/O board for the PCI bus
Part Number	*Description*

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other informative documents:

- EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.
- EN 55022 Class B (1995): Radiated and conducted emission requirements for information technology equipment.
- ENV 50204 (1995): Radio-frequency electromagnetic field immunity.
- EN 55024 (1998): EC generic immunity requirements.
- EN50082-1 (1997): EC generic immunity requirements.
- EN 61000-4-2 (1995): Electrostatic discharge immunity.
- EN 61000-4-3 (1997) ENV 50204 (1996): RF immunity.
- EN 61000-4-4 (1995): Electric fast transient burst immunity.
- EN 61000-4-5 (1995): Surge immunity.
- EN 61000-4-6 (1996): Radio frequency common mode immunity.
- EN 61000-4-8 (1994): Power frequency magnetic field immunity.
- EN 61000-4-11 (1994): Voltage dip and interrupt immunity.

Carl Haapaoja, Vice-President of Design Verification

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